AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

 1-6.   (Cancelled)

 7.   (New) A method for manufacturing a silicon single crystal rod which pulls a silicon single crystal rod (24) from a silicon melt (13) made molten by a heater (17), detects a change in diameter of the silicon single crystal rod (24) in the pulling process at time intervals, and feeds back an output of the detection to the pulling speed of the silicon single crystal rod (24) and the temperature of the heater (17), thereby controlling the diameter of the silicon single crystal rod (24), and

 wherein a PID control in which a PID constant is changed on a plurality of stages is applied to controlling the pulling speed of the silicon single crystal rod (24) and the controlling of the temperature of the heater (17) so that the silicon single crystal rod (24) has a desired target diameter,

 wherein the PID constant in the PID control is increased and the control which gives precedence to the diameter control for the silicon single crystal rod is performed when pulling the top portion of the silicon single crystal rod, and

 wherein the PID constant in the PID control is gradually reduced and the control which gives precedence to the pulling speed control for the silicon single crystal rod is performed when pulling the portion following the top portion of the silicon single crystal rod.

 8.   (New) A method for manufacturing a silicon single crystal rod which pulls a silicon single crystal rod (24) from a silicon melt (13) made molten by a heater (17), detects a change in diameter of the silicon single crystal rod (24) in the pulling process at time intervals , and feeds back an output of the detection to the pulling speed of the

silicon single crystal rod (24) and the temperature of the heater (17), thereby controlling the diameter of the silicon single crystal rod (24), and

wherein the diameter deviation between a desired target diameter and a measured diameter of the silicon single crystal rod (24) is imputed to a PID control so that the silicon single crystal rod (24) has the target diameter and which further comprises feeding back a change frequency quantity of the diameter deviation as a deviation to a current pulling speed, and

wherein the pulling speed at the time of the PID control feedback to the previous silicon single crystal rod pulling speed is determined as a reference, a change quantity obtained by subtracting the previous diameter deviation between the target diameter and the measured diameter of the silicon single crystal rod from the current diameter deviation between the target diameter and the measured diameter of the silicon single crystal rod is determined as a deviation, and the previous pulling speed is corrected in the pulling operation for the portion following the top portion of the silicon single crystal rod.

9.   (New) A method for manufacturing a silicon single crystal rod which pulls a silicon single crystal rod (24) from a silicon melt (13) made molten by a heater (17), detects a change in diameter of the silicon single crystal rod (24) in the pulling process at time intervals , and feeds back an output of the detection to a pulling speed of the silicon single crystal rod (24) and a temperature of the heater (17), thereby controlling a diameter of the silicon single crystal rod (24),

wherein, when feeding back a change quantity of a diameter deviation between a target diameter and a measured diameter of the silicon single crystal rod (24) as a deviation to the pulling speed of the silicon single crystal rod (24), the pulling speed is subjected to a PID control so as not to exceed a maximum fluctuation breadth of correction with respect to a current pulling speed, and

wherein, when the maximum fluctuation breadth of the correction with respect to the current pulling speed is exceeded when pulling the silicon single crystal rod, this correction is restricted to the maximum fluctuation breadth.

10.   (New) A method for manufacturing a silicon single crystal rod wherein a PID control in which a PID constant is changed on a plurality of stages is applied to a method which controls the pulling speed of the silicon single crystal rod so that the silicon single crystal rod has a target diameter and a method which controls the temperature of the heater (17) so that the silicon single crystal rod has the target diameter,

wherein a quality prediction calculation for the silicon single crystal rod (24) is performed by using a pulling speed actual measurement profile from start of puling to a predetermined time and a set pulling speed from start of puling to end of puling concurrently with pulling of the silicon single crystal rod (24), and whether a defective portion is generated in the silicon single crystal rod (24) is predicted, and

wherein, when generation of the defective portion is predicted, a corrected pulling speed of the silicon single crystal rod (24) and a corrected heater temperature which are used to correct the defective portion are calculated, and the corrected pulling speed and the corrected heater temperature are fed back to the set pulling speed and the set heater temperature, and

wherein the quality prediction calculation and the corrected pulling speed calculation for the silicon single crystal rod (24) are performed by a defect simulation method which maximizes a non-defective area in the silicon single crystal rod (24) by using a computer, the defect simulation method comprising:

a step of obtaining a temperature distribution in the silicon single crystal rod (24) which grows from the silicon melt (13) while taking a convection of the silicon melt (13) into consideration under a condition for manufacturing the silicon single crystal rod (24) with a parameter P1;

a step of predicting concentration distributions and size distributions of a void and a high-temperature oxygen precipitate in the silicon single crystal rod (24) by obtaining the temperature distribution in the silicon single crystal rod (24) in the cooling process;

a step of obtaining a difference between a maximum value of an inflection point of a first isoconcentration line and a minimum value of an inflection point of a first distribution line by a calculation after acquiring the first isoconcentration line and the first distribution line in the silicon single crystal rod (24) by a calculation;

a step of obtaining the difference between the maximum value of the inflection point of the first isoconcentration line and the minimum value of the inflection point of the first distribution line by the calculation while sequentially changing the parameter in the condition for manufacturing the silicon single crystal rod (24) from P_2 to P_N; and

a step of obtaining a condition for manufacturing the silicon single crystal rod (24) under which the difference between the maximum value of the inflection point of the first isoconcentration line and the minimum value of the inflection point of the first distribution line becomes maximum.

11.   (New) A method for manufacturing a silicon single crystal rod wherein a method which directly feeds back a diameter deviation between a target diameter and a measured diameter of the silicon single crystal rod (24) to a method which subjects the pulling speed of the silicon single crystal rod (24) to a PID control so that the silicon single crystal rod (24) has the target diameter is combined with a method which feeds back a change quantity of the diameter deviation as a deviation to a current pulling speed,

wherein a quality prediction calculation for the silicon single crystal rod (24) is performed by using a pulling speed actual measurement profile from start of puling to a predetermined time and a set pulling speed from start of puling to end of puling concurrently with pulling of the silicon single crystal rod (24), and whether a defective portion is generated in the silicon single crystal rod (24) is predicted, and

wherein, when generation of the defective portion is predicted, a corrected pulling speed of the silicon single crystal rod (24) and a corrected heater temperature which are used to correct the defective portion are calculated, and the corrected pulling speed and the corrected heater temperature are fed back to the set pulling speed and the set heater temperature, and

wherein the quality prediction calculation and the corrected pulling speed
calculation for the silicon single crystal rod (24) are performed by a defect simulation
method which maximizes a non-defective area in the silicon single crystal rod (24) by
using a computer, the defect simulation method comprising:

a step of obtaining a temperature distribution in the silicon single crystal rod (24)
which grows from the silicon melt (13) while taking a convection of the silicon melt (13)
into consideration under a condition for manufacturing the silicon single crystal rod (24)
with a parameter P1;

a step of predicting concentration distributions and size distributions of a void and
a high-temperature oxygen precipitate in the silicon single crystal rod (24) by obtaining
the temperature distribution in the silicon single crystal rod (24) in the cooling process;

a step of obtaining a difference between a maximum value of an inflection point
of a first isoconcentration line and a minimum value of an inflection point of a first
distribution line by a calculation after acquiring the first isoconcentration line and the first
distribution line in the silicon single crystal rod (24) by a calculation;

a step of obtaining the difference between the maximum value of the inflection
point of the first isoconcentration line and the minimum value of the inflection point of
the first distribution line by the calculation while sequentially changing the parameter in
the condition for manufacturing the silicon single crystal rod (24) from P2 to PN; and

a step of obtaining a condition for manufacturing the silicon single crystal rod (24)
under which the difference between the maximum value of the inflection point of the first
isoconcentration line and the minimum value of the inflection point of the first distribution
line becomes maximum.

12.   (New) A method for manufacturing a silicon single crystal rod wherein,
when feeding back a change quantity of a diameter deviation between a target diameter
and a measured diameter of the silicon single crystal rod (24) as a deviation to the
pulling speed of the silicon single crystal rod (24), the pulling speed is subjected to a
PID control so as not to exceed a maximum fluctuation breadth of correction with
respect to a current pulling speed, and

wherein a quality prediction calculation for the silicon single crystal rod (24) is performed by using a pulling speed actual measurement profile from start of puling to a predetermined time and a set pulling speed from start of puling to end of puling concurrently with pulling of the silicon single crystal rod (24), and whether a defective portion is generated in the silicon single crystal rod (24) is predicted, and

wherein, when generation of the defective portion is predicted, a corrected pulling speed of the silicon single crystal rod (24) and a corrected heater temperature which are used to correct the defective portion are calculated, and the corrected pulling speed and the corrected heater temperature are fed back to the set pulling speed and the set heater temperature, and

wherein the quality prediction calculation and the corrected pulling speed calculation for the silicon single crystal rod (24) are performed by a defect simulation method which maximizes a non-defective area in the silicon single crystal rod (24) by using a computer, the defect simulation method comprising:

a step of obtaining a temperature distribution in the silicon single crystal rod (24) which grows from the silicon melt (13) while taking a convection of the silicon melt (13) into consideration under a condition for manufacturing the silicon single crystal rod (24) with a parameter P1;

a step of predicting concentration distributions and size distributions of a void and a high-temperature oxygen precipitate in the silicon single crystal rod (24) by obtaining the temperature distribution in the silicon single crystal rod (24) in the cooling process;

a step of obtaining a difference between a maximum value of an inflection point of a first isoconcentration line and a minimum value of an inflection point of a first distribution line by a calculation after acquiring the first isoconcentration line and the first distribution line in the silicon single crystal rod (24) by a calculation;

a step of obtaining the difference between the maximum value of the inflection point of the first isoconcentration line and the minimum value of the inflection point of the first distribution line by the calculation while sequentially changing the parameter in the condition for manufacturing the silicon single crystal rod (24) from P_2 to P_N; and

a step of obtaining a condition for manufacturing the silicon single crystal rod (24) under which the difference between the maximum value of the inflection point of the first isoconcentration line and the minimum value of the inflection point of the first distribution line becomes maximum.

13.   (New) The method for manufacturing a silicon single crystal rod according to claim 10,

wherein the quality prediction calculation and the corrected pulling speed calculation for the silicon single crystal rod (24) are performed by a defect simulation method which maximizes a non-defective area in the silicon single crystal rod (24) by using a computer, the defect simulation method comprising:

a step of obtaining a temperature distribution in the silicon single crystal rod (24) which grows from the silicon melt (13) while taking a convection of the silicon melt (13) into consideration under a condition for manufacturing the silicon single crystal rod (24) with a parameter P1;

a step of predicting concentration distributions and size distributions of a void and a high-temperature oxygen precipitate in the silicon single crystal rod (24) by obtaining the temperature distribution in the silicon single crystal rod (24) in the cooling process;

a step of obtaining a difference between a maximum value of an inflection point of a second isoconcentration line and a minimum value of an inflection point of a second distribution line by a calculation after acquiring the second isoconcentration line and the second distribution line in the silicon single crystal rod (24) by a calculation;

a step of obtaining the difference between the maximum value of the inflection point of the second isoconcentration line and the minimum value of the inflection point of the second distribution line by the calculation while sequentially changing the parameter in the condition for manufacturing the silicon single crystal rod (24) from P2 to PN; and

a step of obtaining a condition for manufacturing the silicon single crystal rod (24) under which the difference between the maximum value of the inflection point of the

second isoconcentration line and the minimum value of the inflection point of the second distribution line becomes maximum.

14.   (New) The method for manufacturing a silicon single crystal rod according to claim 11,

wherein the quality prediction calculation and the corrected pulling speed calculation for the silicon single crystal rod (24) are performed by a defect simulation method which maximizes a non-defective area in the silicon single crystal rod (24) by using a computer, the defect simulation method comprising:

a step of obtaining a temperature distribution in the silicon single crystal rod (24) which grows from the silicon melt (13) while taking a convection of the silicon melt (13) into consideration under a condition for manufacturing the silicon single crystal rod (24) with a parameter P1;

a step of predicting concentration distributions and size distributions of a void and a high-temperature oxygen precipitate in the silicon single crystal rod (24) by obtaining the temperature distribution in the silicon single crystal rod (24) in the cooling process;

a step of obtaining a difference between a maximum value of an inflection point of a second isoconcentration line and a minimum value of an inflection point of a second distribution line by a calculation after acquiring the second isoconcentration line and the second distribution line in the silicon single crystal rod (24) by a calculation;

a step of obtaining the difference between the maximum value of the inflection point of the second isoconcentration line and the minimum value of the inflection point of the second distribution line by the calculation while sequentially changing the parameter in the condition for manufacturing the silicon single crystal rod (24) from P2 to PN; and

a step of obtaining a condition for manufacturing the silicon single crystal rod (24) under which the difference between the maximum value of the inflection point of the second isoconcentration line and the minimum value of the inflection point of the second distribution line becomes maximum.

15.   (New) The method for manufacturing a silicon single crystal rod according to claim 12,

wherein the quality prediction calculation and the corrected pulling speed calculation for the silicon single crystal rod (24) are performed by a defect simulation method which maximizes a non-defective area in the silicon single crystal rod (24) by using a computer, the defect simulation method comprising:

a step of obtaining a temperature distribution in the silicon single crystal rod (24) which grows from the silicon melt (13) while taking a convection of the silicon melt (13) into consideration under a condition for manufacturing the silicon single crystal rod (24) with a parameter P1;

a step of predicting concentration distributions and size distributions of a void and a high-temperature oxygen precipitate in the silicon single crystal rod (24) by obtaining the temperature distribution in the silicon single crystal rod (24) in the cooling process;

a step of obtaining a difference between a maximum value of an inflection point of a second isoconcentration line and a minimum value of an inflection point of a second distribution line by a calculation after acquiring the second isoconcentration line and the second distribution line in the silicon single crystal rod (24) by a calculation;

a step of obtaining the difference between the maximum value of the inflection point of the second isoconcentration line and the minimum value of the inflection point of the second distribution line by the calculation while sequentially changing the parameter in the condition for manufacturing the silicon single crystal rod (24) from P2 to PN; and

a step of obtaining a condition for manufacturing the silicon single crystal rod (24) under which the difference between the maximum value of the inflection point of the second isoconcentration line and the minimum value of the inflection point of the second distribution line becomes maximum.